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Clinical Outcomes of ACL Reconstruction with B-P T-B Auto Graft Versus Hamstring Graft

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Abstract

Introduction: Restoration of the stability of the knee joint is the main goal of the ACL reconstruction. Other benefits include allowing the patient to return to normal activities, including sports; and to delay the onset of osteoarthritis with associated recurrent injuries to the articular cartilage and loss of meniscal functions. Surgical management of the anterior cruciate ligament deficient knee has been evolved from the primary repair to anterior cruciate ligament reconstruction using biologic tissue grafts. *Methodology:* A prospective and retrospective study was conducted in the Department of Orthopedics, and about 30 patients with anterior cruciate ligament injury attending the department of Orthopedics were included in the study. *Results:* After two years, 86.7% of the patients in PTB group and 93.3% in the STG group had extensor lag of less than 3 degrees. About 13.3% of the patients in PTB group and 6.7% in the STG group had extensor lag of 3–5 degrees. *Conclusion:* The clinical and functional evaluation of both the grafts was found to be same with slight preponderance towards hamstring grafts.

Keywords: ACL Reconstruction; Hamstring Grafts; Articular Cartilage.

Introduction

The main causes for Anterior Cruciate Ligament Injury are the fast moving vehicles like motorcycle, football, increased fitness awareness and highly competitive sports. The mechanism involved in rupture of Anterior Cruciate Ligament injury is hyperextension of the knee. The rupture of Anterior Cruciate ligament results in disintegration of synchronous rolling and gliding movements of the knee and causes uneven load distribution through the knee joint. The Anterior Cruciate Ligament is the primary stabilizer against anterior translation of the tibia on the femur and is important in counteracting rotation and valgus stress [1].

Restoration of the stability of the knee joint is the main goal of the ACL reconstruction. Other benefits include allowing the patient to return to normal activities, including sports; and to delay the onset of osteoarthritis with associated recurrent injuries to the articular cartilage and loss of meniscal functions [2,3]. Surgical management of the anterior cruciate ligament deficient knee has been evolved from the primary repair to anterior cruciate ligament reconstruction using biologic tissue grafts. In the past three decades, a variety of methods to stabilize the knee in the ACL has been torn have been tried and discarded. Techniques that have not withstand the test of time include primary repair of the torn ACL, lateral extra–articular reconstruction (Ellison, McIntosh), dynamic operations (pesanserinus), synthetic augmentation (ligament augmentation device), prosthetic replacement (Gortex, Leeds – Keio, Dacron), vascularized grafts and thermal shrinkage. Intra articular replacement of the torn ACL with a

biologic graft has evolved to be most commonly used operation today [4].

The most commonly used autografts include bony patellar tendon or combined semitendinosus and gracilis hamstring tendon grafts for the better functional outcome. The decision of selecting the appropriate grafts for an individual patient depends upon the operating surgeon. The ideal graft for Anterior Cruciate Ligament reconstruction would consist of: reproduce the histological and biomechanical characteristics of the native ligament: incorporate fully and quickly within bone tunnels: have no risk of rejection or disease transmission: minimal donor – site morbidity: be of sufficient length and diameter and be cost effective as well as readily available. The gold standard graft is not available. The autografts used for reconstruction of ACL include Bone patellar tendon bone, hamstrings, Quadriceps tendon and fascia lata. The allografts include Bone patellar tendon bone, Hamstrings, Qudriceps tendon, Tibialis anterior or posterior tendon, Achilles tendon and Fascia lata. The Synthetic grafts include Scaffolds, Stent prostheses. These grafts have their own advantages and disadvantages [5].

The available literature suggests that the bone patellar tendon – bone autograft is considered to be the gold standard in ACL reconstruction because of bone to bone healing which allows of early and accelerated rehabilitation with documented good and excellent long term results. It provides better graft width, availability, strong primary fixation, preservation of active internal rotation, acquires ligamentization and adapts to suit its structure and new environment The hamstring tendon grafts have increased in popularity nowadays as an alternative to the bone patellar tendon bone graft. The advantages of the hamstring tendon compared to bone patellar bone graft are reduced donor site morbidity associated with fewer kneeling problems and muscular deficits and less anterior knee pain in the long term follow up. The studies have shown that the hamstring tendon ACL reconstruction results in poorer static knee stability when compared with the patellar tendon graft. The complications of Hamstring tendon graft include increased anterior knee laxity, decreased flexion strength of the knee and sensory deficit [6].

The review of literature suggests that B-P T–B graft is most frequently used with the minimum complications among all the grafts. Hence, this study was taken up in order to study the advantages and disadvantages of B-P T-B grafts with hamstring tendon graft.

Methodology

A prospective and retrospective study was conducted in the Department of Orthopedics, and about 30 patients with anterior cruciate ligament injury attending the department of Orthopedics were included in the study. An informed, bilingual consent was obtained from each patient before they were included in to the study. The inclusion and exclusion criteria were as follows-

Inclusion Criteria

- ACL injury in young active individuals with or without meniscus injury.
- Associated with symptoms of instability.
- In patients aged 15 -50 years.

Exclusion Criteria

- ACL injury in individuals associated with Osteoarthritis.
- ACL avulsion fractures and multi ligament injuries.
- In skeletally immature patients.

About 30 patients who satisfied the inclusion and exclusion criteria were divided in to two equal groups of 15 patients each. The type of graft tissue used for reconstruction (bone – patellar tendon – bone versus hamstring tendon autograft) was not randomized. Bone – patellar tendon – bone autografts were used for those who wished to return to high-level activities and hamstring tendon autografts for those who had low level activities or were concerned about cosmesis. The outcome testing in all cases was performed at the latest follow–up (at least one year).

All patients were followed–up initially by the operating surgeon. All final clinical testing and evaluation were performed by the other independent surgeon from one year post – operation to eliminate potential for bias. The evaluation included supine range of motion measurements with goniometer, effusion, joint line tendernessand patella femoral crepitation, as well as checking for associated complications. Stability testing included the Lachman test, Anterior drawer test, pivot shift test. Ligamentous laxity was graded as 1+ (0 – 2 mm), 2+ (3–5 mm), 3+ (6–9) mm, 4+ (> 10 mm). A single legged hop for distance was used for functional testing. The test was performed three times and averaged.

The data thus obtained was entered in to a excel spreadsheet. The data was analysed using Statistical Package for Social Services (SPSS vs 20). The categorical data was presented as frequencies and percentages. The quantitative data was presented as measures of the central tendency and dispersion.

Results

Table 1: Distribution of the study groups according to IKDC score at 1 year

IKDC score at 1 Year	PTB group N (%)	STG group N (%)
C	15 (100)	15 (100)
Total	15 (100)	15 (100)

All the patients in both the groups were categorized as "C" for IKDC at 1year.

Table 2: Distribution of the study groups according to IKDC score at 2 years

IKDC score at 2 Years	PTB group N (%)	STG group N (%)
B	10 (66.7)	11 (73.3)
C	5 (33.3)	4 (26.7)
Total	15 (100)	15 (100)

About 66.7% patients in PTB group and 73.3% in the STG group were able todo strenuous activities like heavy physical work two years after surgery

Table 3: Distribution of the study groups according to effusion at 1 year

Effusion at 1 year	PTB group N (%)	STG group N (%)
None	14 (93.3)	15 (100)
Mild	1 (6.7)	0
Total	15 (100)	15 (100)

Mild effusion was present in 6.7% of the patients of PTB group. About 93.3% of the PTB group patients and all the patients in STG group had no effusion at the end of one year.

Table 4: Distribution of the study groups according to effusion at 2 years

Effusion at 2 Years	PTB group N (%)	STG group N (%)
None	15 (100)	15 (100)
Total	15 (100)	15 (100)

Two years after the surgery no patients in PTB and STG group had effusion ofthe knee.

Table 5: Distribution of the study groups according to Lack of extension at 1

Lack of extension at 1 year	PTB group N (%)	STG group N (%)
< 3 deg	11 (73.3)	12 (80.0)
3 – 5 deg	4 (26.7)	3 (20.0)
Total	15 (100)	15 (100)

About 73.3% of the patients in PTB group and 80% of the patients in STG group had extensor lag of less than 3 degrees. About 26.7% of the patients in PTB group and 20% of the patients in STG group had extensor lag of 3–5 degrees.

Table 6: Distribution of the study groups according to lack of extension at 2 years

Lack of extension at 2 years	PTB group N (%)	STG group N (%)
< 3 deg	13 (86.7)	14 (93.3)
3 – 5 deg	2 (13.3)	1 (6.7)
Total	15 (100)	15 (100)

After two years, 86.7% of the patients in PTB group and 93.3% in the STG group had extensor lag of less than 3 degrees. About 13.3% of the patients in PTB group and 6.7% in the STG group had extensor lag of 3–5 degrees.

Table 7: Distribution of the study groups according to lack of flexion at 1 year

Lack of flexion at 1 year	PTB group N (%)	STG group N (%)
0– 5 deg	12 (80.0)	12 (80.0)
6– 15 deg	2 (13.3)	3 (20.0)
16 – 25 deg	1 (6.7)	0
Total	15 (100)	15 (100)

In PTB group, about 80% of the patients had lack of flexion of 0–5 degrees, 13.3% had 6–15 degrees and 6.7% had lack of flexion of 16–25 degrees. In STG group, about 80% had lack of flexion of 0–5 degrees and 20% had lack of flexion of 6–15 degrees.

Table 8: Distribution of the study groups according to lack of flexion at 2 years

Lack of flexion at 2 years	PTB group N (%)	STG group N (%)
0– 5 deg	13 (86.7)	15 (100)
6– 15 deg	2 (13.3)	0
Total	15 (100)	15 (100)

After two years, 86.7% of the patients in PTB group and all the patients belonging to STG group had lack of flexion of 0–5 degrees and 13.3% of the patients in PTB group had lack of flexion of 6–15 degrees.

Table 9: Distribution of the study groups according to anterior drawers test at 1 year

Anterior drawers test at 1 year	PTB group N (%)	STG group N (%)
0 – 2 mm	13 (86.7)	13 (86.7)
3 – 5 mm	2 (13.3)	2 (13.3)
Total	15 (100)	15 (100)

After one year, 86.7% of the patients in PTB group and 86.7% in the STG group had ACL laxity of 0–2 mm. About 13.3% in the PTB group and STG group had ACL laxity of 3–5 mm.

Table 10: Distribution of the study groups according to anterior drawers test at 2 years

Anterior drawers test at 2 years	PTB group N (%)	STG group N (%)
0 – 2 mm	13 (86.7)	13 (86.7)
3 – 5 mm	2 (13.3)	2 (13.3)
Total	15 (100)	15 (100)

After two years, about 86.7% of the patients in both the groups had ACL laxity of 0–2 mm and 13.3% had ACL laxity of 3–5 mm as tested by Anterior drawyer's test.

About 80% of the patients in both the groups had ACL laxity of 0 – 2 mm and 20% had patients in both the groups had ACL laxity of 3–5 mm tested by Lachman's test.

After two years, 86.7% of the patients in both the groups had ACL laxity of 0– 2 mm and 13.3% of the patients in both the group had ACL laxity of 3–5 mm as tested by Lachman's test.

At the end of one year, about 20% of the patients in PTB group had patello – femoral pain and none of the patients in STG group had patella – femoral pain.

At the end of two years, none of the patients in the two groups hadcompartment findings.

At the end of 1 year, about 86.7% of the patients in PTB group and all the patients in STG group had no pain. About 13.3% of the patients in the PTB group had graft site pathology.

At the end of two years, none of the patients in PTB group and STG group hadno graft site pathology.

Discussion

All the patients in both the groups were categorized as "C" for IKDC at 1 year. About 66.7% patients in PTB group and 73.3% in the STG group were able to do strenuous activities like heavy physical work, two years after surgery. In a study by Aglietti et al, The mean IKDC score in BPTB group was 73 and DSTG group was 72 at 4 months, 80 and 82 respectively at 1 year post operative period and 82 and 85 at 2 years post op [7]. In a study by Wagner et al, about 58% in patellar tendon group and 67% of the patients in Hamstring tendon group scored C

grade upon IKDC scoring [8].

Mild effusion was present in 6.7% of the patients of PTB group and all the patients in STG group had no effusion at the end of one year. Two years after the surgery, no patients in PTB and STG group had effusion of the knee. In a study by Wagner et al, about 87% of the patients in Patellar tendon group and 95% of the hamstring group had grade A effusion [8].

About 73.3% of the patients in PTB group and 80% of the patients in STG group had extensor lag of less than 3 degrees. After two years of the surgery, 86.7% of the patients in PTB group and 93.3% in the STG group had extensor lag of less than 3 degrees. In a study by Wagner et al, 91% of the patellar tendon group and 96% of the hamstring tendon group had grade "A" extension [8].

In PTB group, about 80% of the patients had lack of flexion of 0 – 5 degrees and in STG group, about 80% had lack of flexion of 0 – 5 degrees. After two years, 86.7% of the patients in PTB group and all the patients belonging to STG group had lack of flexion of 0 – 5 degrees. In a study by Pathania et al [51] noted 8% of the patients had restriction of last 10^0 of flexion and 8% had deficit of 5^0. In a study by Wagner et al, 86% of the patellar tendon group and 98% of the hamstring group had grade "A"flexion [8].

After one year, 86.7% of the patients in PTB group and 86.7% in the STG group had ACL laxity of 0 – 2 mm and even after two years. In a study by Wagner et al, 55% of the patients in patellar tendon group and 98% in Hamstring tendon group had grade "A" translation with 25^0 flexion [8].

About 80% of the patients in both the groups had ACL laxity of 0 – 2 mm and after two years, 86.7% of the patients in both the groups had ACL laxity of 0 – 2 mm. In a study by Agletti et al, all the patients in both the groups was restored with a firm end point, in all pateints for all follow up visits for up to two years [7]. In a study by Freedman et al, higher proportion in the patellar tendon group had a difference of less than 3 mm on KT – 1000 arthrometer testing than in the hamstring tendon group. They concluded that patellar tendon autographs had a significantly lower rate of failure and resulted in better knee stability and increased patient satisfaction compared with hamstring tendon autografts. Patellar autograft reconstruction resulted in an increased rate of anterior knee pain [9].

At the end of one year, about 20% of the patients in PTB group none in STG group had patella – femoral pain. At the end of two years, none of the patients in the two groups had compartment findings. In a study by Aglietti et al, the mean pain score was 89 and 91 in BPTB and BSTG groups respectively at 4 months, 90 and 94 at 1 year post operative period and 82 and 85 at 2 years post operative period. At two years' post operative period moderate but asymptomatic, patella femoral crepitation was recorded in 22% of the patients of BPTB group and 23% in Hamstring group [7]. In a study by Wagner et al, 89% of the patients in Patellar tendon group and % in hamstring tendon group had pain after surgery [8].

At the end of 1 year, about 86.7% of the patients in PTB group and all the patients in STG group had no pain and at the end of two years, none of the patients in PTB group and STG group had no graft site pathology. In a study by Corry et al, the hamstring tendon group had lower graft site morbidity. In a study by Agletti et al, 62% of the patients in BPTB group and 15% in the hamstring group had kneeling discomfort [7].

About 66.7% of the patients in PTB group and 60% of the patients in STG group were able to do more than 90% of single leg functional hop test 2 years after surgery. At the end of two years, about 86.7% of the patients in PTB group and 73.3% of the patients in STG group were able perform more than 90% of functional hop test. In a study by Wagner et al, 69% in patellar tendon group and 89% in hamstring group had normal one legged hop test [8]. In a study by Martin et al, the Cincinnati scores were equal in both PTB and hamstring groups after 2 years [10]. In a metanalysis by Yunes et al, patellar tendon graft patients had greater chance of returning to pre – injury activity levels. They also concluded that both techniques yielded good results, patellar tendon reconstruction led to higher postoperative activity levels and greater static stability that the hamstring reconstruction.

Conclusion

This study was undertaken mainly to study the efficacy of patellar tendon–bone tendon grafting and hamstring tendon grafting. The clinical and functional evaluation of both the grafts was found to be same with slight preponderance towards hamstring grafts. The functional evaluation was slightly towards PBTB grafts. However, this study is not without limitations. A prospective and retrospective methodology was good but not better than a randomized trial. The sample size estimation was not done in this study. The sampling method was not followed to pick the samples. The record based retrospective method precludes the

generalizability of the results of the study. But, this study was able to bring out important facts of PBTB grafts and hamstring grafts. Further research in this direction with a sound methodology is helpful to generalize the results.

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